

# Anaerobic Digestion: Environmental Performance & Initial Considerations

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# Benefits of Anaerobic Digestion with Biogas Utilization

- Odor Control
- Renewable energy production
- Reduction in methane emissions
- Surface water quality protection
- Enteric pathogen reduction
- Possible increase in net farm income

# Past Successes

## Swine

- Barham Farms (1998)
- Colorado Pork (1999)
- Royal Farms (1982)
- Rocky Knoll Swine Farm (1985)
- Apex Pork (1998)

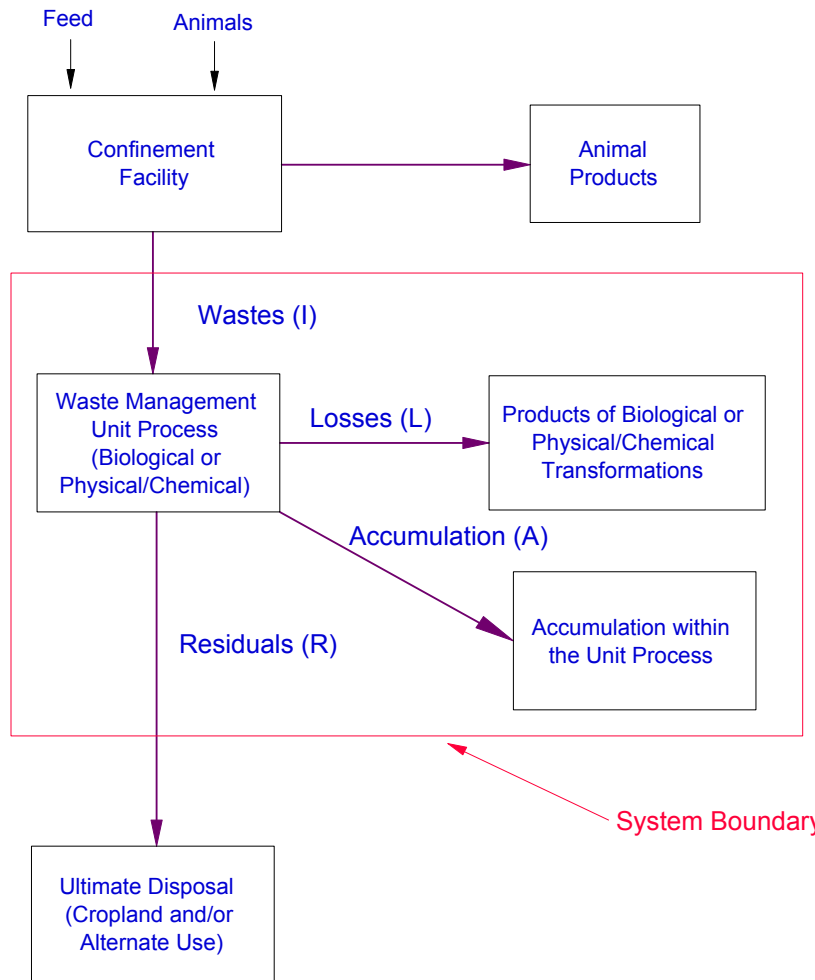
## Dairy

- Mason Dixon Farm
- Cooperstown Dairy
  - In continuous operation since the 1970s.

# AgSTAR North Carolina Performance Evaluation

Comparison of an unheated,  
covered anaerobic lagoon with an  
effluent storage pond (Barham  
Farms) and a conventional  
anaerobic lagoon.

# Evaluation Protocol Based

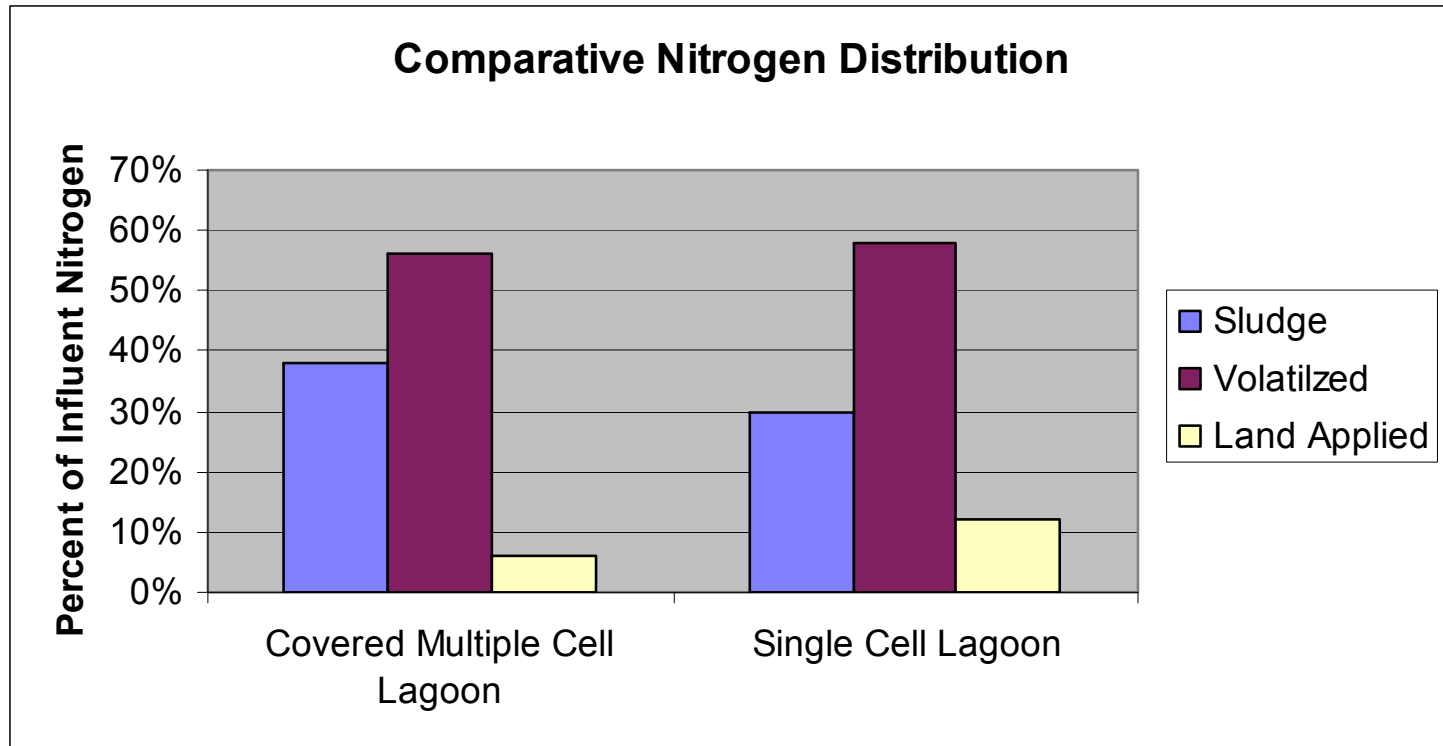


## Performance Parameters

Oxygen demand  
Nutrients - Nitrogen & Phosphorus  
Indicator Organisms  
Metals

Where :  $L = I - (R + A)$   
(I and R are measured and  
L and A are estimated)

# Fate of Nitrogen



- Comparative reductions of Phosphorus (Total & Ortho) were ~97% for each system

# Waste Stabilization

PARAMETER	Covered lagoon w/ separate storage Reductions, %			Combined treatment storage lagoon Reductions, %
	Covered lagoon	Storage pond	Total	Total
Total solids	90.1	7.7	97.8	95.6
Total volatile solids	95.4	3.7	99.1	98.9
Fixed solids	76.9	18	94.9	91.5
Chemical oxygen demand	97	2.8	99.8	99

Martin J.H. Jr., *A Comparison of the Performance of Three Swine Waste Stabilization Systems*, AgSTAR Program deliverable under contract #68-W7-0068, Draft March 2002

# Indicator Organism and Pathogen Reductions, $\log_{10}$

Organism	Covered anaerobic lagoon & effluent storage pond	Conventional anaerobic lagoon
Fecal coliforms	3.6	1.6
<i>E. coli</i>	3.6	1.5
<i>Salmonella</i>	2.7	1.8
<i>C. Perfringens</i> spores	2.5	0.8

Martin J.H. Jr., *A Comparison of the Performance of Three Swine Waste Stabilization Systems*,  
AgSTAR Program deliverable under contract #68-W7-0068, Draft March 2002



# Other Considerations:

## Single vs. Two-Stage Covered Lagoons

- Impact on nutrient management: Single stage systems will have lower  $\text{NH}_4\text{-N}$  losses but less effectively store P.
- Impact on biogas production: There will be less seasonal variability in biogas production and greater yield with two-stage systems.

# Initial Considerations

- Commitment
- Financial ability
- Size (No. of animals)
- Current manure management practices
- Developer
- Utility

# Commitment

- Why do I want to do this?
- Do I have the time to put the necessary prerequisites in place (choosing a developer, arranging financing, etc.)?
- Do I have the time and staff for effective system operation and maintenance?

# Project Financing

- Availability of government cost share and low interest loan programs.
- Availability of internally derived capital.
- Ability to assume additional debt.
- Tradeoffs.

# Financing

- Perform a detailed financial analysis of the project.
- Treat the project as a separate enterprise with biogas energy used on-site as a source of revenue.
- Consider an energy audit for determining the potential for on-site biogas use to maximize financial benefits.
- Include recovery of your capital investment with interest.

# Third Party Ownership and/or Operation

# Herd Size for 100 kW Generating Capacity

- Farrow-to-Wean: ~3,900 sows
- Grow-Finish: ~3,800 head capacity

# Manure Management Requirements

- No less frequently than weekly collection—at least daily is preferable.
- The less water the better.
- Free of foreign material (e.g., soil, stones, *etc.*)



# Selecting a Developer

- Solicit competing proposals and cost estimates.
- Talk with previous clients.
- Insist on a fixed price contract.
- Require a detailed O & M manual.
- Require at least 12 months of technical assistance after start-up.
- Warranty.

# Utility Negotiations

- Contract options – buy all-sell all, surplus sale, net metering, etc.
- What is the differential between retail and wholesale prices?
- Carefully consider avoided rate schedules, interconnection requirements, standby charges, *etc.*
- Who will own RECs, carbon credits, *etc.*
- Is wheeling power possible?
- What is the term of the contract and are rates adjustable?

# Additional Sources of Information

- FarmWare and the AgSTAR Handbook—  
<http://www.epa.gov/agstar/resources.html>
- The 4th AgSTAR Conference, Baltimore, MD,  
February 24-25, 2009

# Thank-you

## Questions?